

## CLAIMS

1. A method for diagnosing degradation of a NOx-reducing catalyst, comprising:

5       calculating an actual exotherm across the catalyst based on temperature measurements upstream and downstream of the catalyst;

          calculating an expected exotherm across the catalyst based at least on an amount of reductant stored in the catalyst and an amount of reductant in an exhaust gas mixture entering the catalyst; and

          providing an indication of degradation based on a comparison of said actual exotherm and said expected exotherm.

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2. The method as set forth in Claim 1 wherein the NOx-reducing catalyst in an ALNC.

3. The method as set forth in Claim 1 wherein the NOx-reducing catalyst is an oxidation catalyst.

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4. The method as set forth in Claim 1 wherein said reductant is hydrocarbon.

5. The method as set forth in Claim 4 further comprising adjusting an amount of reductant injection into said NOx-reducing catalyst in response to said indication of degradation.

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6. A diagnostic system, comprising:

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      a NOx-reducing catalyst coupled downstream of an internal combustion engine; and

      a controller introducing reductant into an exhaust gas mixture entering said NOx-reducing catalyst, said

controller further calculating an amount of reductant stored in said NOx-reducing catalyst, and estimating an exotherm across said ALNC based at least on said amount of reductant stored in said NOx-reducing catalyst and on an amount of reductant in said exhaust gas mixture entering  
5 said NOx-reducing catalyst.

7. The system as set forth in Claim 6 further comprising a second temperature sensor providing a  
10 measurement of a NOx-reducing catalyst inlet temperature.

8. The system as set forth in Claim 7 wherein said controller further calculates an actual exotherm across said NOx-reducing catalyst based on said inlet and outlet  
15 temperature measurements.

9. The system as set forth in Claim 8 wherein said reductant is hydrocarbon.

20 10. The system as set forth in Claim 9 wherein said controller further estimates said exotherm across said NOx-reducing catalyst based on said inlet temperature measurement.

25 11. The system as set forth in Claim 10 wherein said controller further compares said estimated and said actual exotherm and provides an indication of degradation based on said comparison.

30 12. The system as set forth in Claim 11 wherein said controller further adjusts an amount of reductant introduced into said exhaust gas mixture entering said NOx-reducing catalyst based on said indication of degradation.

13. A method for estimating a temperature of a NOx-reducing catalyst, comprising:

estimating an amount of reductant stored in the catalyst; and

5 estimating a catalyst temperature based at least on said estimated amount of reductant stored in the catalyst and on an amount of reductant in an exhaust gas mixture entering the catalyst.

10 14. The method as set forth in Claim 11 wherein said NOx-reducing catalyst temperature estimate is further based on a temperature measurement upstream of the NOx-reducing catalyst.

15 15. The method as set forth in Claim 14 further based on mass airflow.

16. A method for estimating an exotherm across a NOx-reducing catalyst coupled downstream of an internal  
20 combustion engine, comprising:

providing an indication that a catalyst temperature is above light-off;

in response to said indication, increasing reductant injection into the catalyst by a predetermined amount; and

25 calculating an expected exotherm based on said predetermined increased reductant injection amount and on an amount of reductant stored in the catalyst.

17. The method as set forth in Claim 16 wherein the  
30 NOx-reducing catalyst is an ALNC.

18. The method as set forth in Claim 16 wherein the NOx-reducing catalyst is an oxidation catalyst.

19. The method as set forth in Claim 16 wherein said reductant is hydrocarbon.

20. The method as set forth in Claim 16 further  
5 comprising calculating an actual exotherm based on at least a temperature measurement downstream of said catalyst.

21. The method as set forth in Claim 20 further  
comprising providing an indication of catalyst degradation  
10 based on a comparison of said actual and said expected change in said exotherm.

22. An article of manufacture comprising:  
a computer storage medium having a computer program  
15 encoded therein for use with an emission control system for an internal combustion engine, said emission control system including at least a NOx-reducing catalyst, said computer program comprising:

code for providing an indication of an operating  
20 condition;  
code for increasing an amount of reductant in an exhaust gas mixture entering the NOx-reducing catalyst by a predetermined value in response to said indication;  
25 code for calculating an expected change in a catalyst temperature based on said predetermined increased reductant injection amount and on a thermodynamic model of the NOx-reducing catalyst, wherein said model takes into account at least an  
30 amount of reductant stored in the catalyst and a catalyst age.

23. The system as set forth in Claim 22 wherein said operating condition is catalyst light-off.